Rule Versus Discretion: Regulatory Uncertainty, Firm Investment, and the Ally Principle

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Regulatory uncertainty, firm investment, and the ally principle

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Abstract

Previous studies of the bureaucracy have focused on the internal relationship between politicians (principals) and bureaucrats (agents). External regulated actors, such as firms, have generally been ignored. But firms strategically respond to their regulatory environment and regulatory uncertainty can deter investment. We examine how concerns about firms' strategic behavior affect the optimal internal organization of the bureaucracy. When regulatory uncertainty is about *how much* firms will be regulated, the *ally principle* applies: the principal delegates to an agent with similar preferences as hers. When regulatory uncertainty is about *whether* firms will be regulated, the ally principle fails to hold: the principal prefers an inefficient rule-based regulatory framework or, if possible, to delegate to an agent with preferences *distinct* from hers to encourage firm investment. We uncover novel endogenous limits to delegation since the principal faces a commitment problem not to replace a biased agent after the firm investment.

1 Introduction

Policies yield no effect unless they are implemented, namely by ministries and agencies. Recognizing the influence of administrative rule-making, many papers have studied the *internal* structure of the bureaucracy: the relationship between politicians (principals) and bureaucrats (agents). In the presence of costless information acquisition, the primary finding from this literature is the *ally principle*: a principal always wants to delegate and grant more discretion to a better informed agents with similar preferences as her own (Krehbiel (1992), Epstein and O'Halloran (1994), Gailmard (2002), Gailmard and Patty (2012b), Huber and Shipan (2002), and Bendor and Meirowitz (2004)).[1] But the effect of regulation does not depend only on the decision of a bureaucratic agent – it is also affected by external actors' strategic behavior, especially firms.

In this paper, we demonstrate that accounting for the strategic responses of firms to the regulatory framework affects predictions about the optimal internal structure of the bureaucracy and can lead to a reversal of the ally principle. This failure of the ally principle occurs even though information acquisition is costless, all agents are equally competent, and there is no incentive problems between the principal and the agent so the principal would *always* want to delegate to a like-minded agent absent firms' strategic responses.

To understand how firms' strategic decisions shape the internal structure of the bureaucracy, it is important to analyze the effect of different regulatory frameworks on regulated firms and the trade-off it entails for the principal. An important consideration for firms is regulatory uncertainty which is often decried as a hindrance to private investment and economic growth. Lloyd Blankfein, the CEO of Goldman Sachs addressed this issue when discussing the domestic gas industry in a recent interview on CNBC:

> We have to resolve some of the uncertainties [. . .] Without stable regulation, without an agreement and a compromise, an accommodation between the forces that are focused on the environment and those that are focused on jobs and

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[1] We discuss papers (e.g. Bendor and Meirowitz (2004),Gailmard and Patty (2012b) and Boehmke et al. (2006)) which highlight conditions under which the ally principle fails in more details below.

growth, we've managed to do a lot of production of energy. What we haven't done is gotten a lot of commitment to build the downstream plants that create the manufacturing and the jobs

-Lloyd Blankfein, the chief executive of Goldman Sachs on CNBC, June 11, 2014

A rule-based regulatory framework establishes clear and unchanging standards and so can resolve uncertainty and encourage investment. But rules do not adapt to circumstances and, unlike a discretion-based regulatory framework, lead to ex-post inefficient regulation. When deciding upon a regulatory framework, a principal who cares about the private (consumer surplus and profit) and social (externality) impact of firm investment must balance this trade-off between certainty and efficiency.

As we show, the principal's choice depends critically on the *nature* of the regulatory uncertainty. Firms face two forms of regulatory uncertainty: *whether they will be regulated* and *how much they will be regulated.* When the first type of uncertainty prevails, compared to discretion, the welfare-maximizing rule can significantly increase the likelihood of investment by the firm: a rule then dominates discretion granted to an (unbiased) agent with similar preferences as the principal's – the ally principle no longer holds. Conversely, when the regulatory uncertainty is how much the firm will be regulated, compared to discretion, the welfare-maximizing rule decreases the likelihood of investment: Discretion then dominates rules. In this circumstance, the ally principle holds.

In our model, regulation mitigates the effects of an externality associated with firm production. However, regulation also increases the costs of production and thus reduces output, firm profit, and consumer surplus. The cost of the externality depends on both the amount produced and the degree of externality that is left unmitigated. As the degree of externality increases, the principal wants more regulation. However, as regulation increases, she has less and less incentives to further increase the level of regulation because the degree of externality left unmitigated is small, quantities produced are low, and the high cost of production generates low profit and consumer surplus. Consequently, as the degree of externality increases, the regulatory cost imposed on the firm increases, but at a decreasing rate. The

firm therefore always prefers a lottery over two strictly positive levels of regulation to the average regulation level. That is, the firm profit under discretion is higher than under a rule. When regulatory uncertainty is about the how much, not the whether, not only is discretion ex-post efficient, but it is also more favorable to firm investment than a rule.

When the regulatory uncertainty faced by the firm is whether it will be regulated, discretion needs not dominate a rule. For a very low degree of externality, it is optimal for the principal to impose no regulation since the loss in consumer surplus and profit associated with any increase in regulation is always greater than the benefit of mitigation. The principal is constrained by the inability of imposing negative level of regulation. In some sense, even no regulation is "over-regulation."

Under discretion, the principal cannot commit to compensate for over-regulation when the degree of externality is low. In fact, when the degree of externality is high, she adapts the level of regulation to the degree of externality. Under a rule, the principal can choose an average level of regulation which takes into account the risk of over-regulation in the low state. Consequently, regulation under the rule can be strictly lower than the average regulation under discretion. The firm's profit is then strictly higher under a rule which increases the likelihood of the firm undertaking costly investment. As investment is socially beneficial, the principal might choose a rule and its associated regulatory certainty over discretion and its associated ex-post efficiency.

The reasoning above implies that even when a principal can delegate its decision to an unbiased agent, she might refrain to do so to gain ex-ante commitment power. However, the principal is always better off when she can delegate to an agent who is sufficiently biased in favor of business (i.e., who weights the firm profit in his decision sufficiently more than the principal). Such an agent chooses the same (zero) level of regulation as the principal when the degree of externality is low. When the degree of externality is high, he under-regulates compared to the principal. However, the level of regulation is closer to the principal's ideal level than the rule while still generating investment by the firm with high probability. Consequently, delegating to a biased agent gives ex-ante commitment power to the principal

while recovering some of the ex-post efficiency. and the principal is necessarily better off. Our model thus predicts that more preference divergence between the principal and an agent can lead to *more* discretion. Moreover, given the choice between an unbiased agent and a pro-business agent, the principal always chooses the latter in these circumstances. The ally principle is completely reversed.

Delegation to a biased agent, however, supposes that the principal can commit not to replace the agent with someone whose preferences are closer to her own once the firm investment has been realized and the degree of externality has been revealed to all. As the expected cost of investment increases, to encourage firm investment, the principal must delegate to an increasingly biased agent. This agent chooses a level of regulation further away from the principal's ideal whenever the degree of externality is high. Even if replacing the agent is costly, the commitment of not doing so then becomes more and more tenuous. Limits to delegation thus naturally arise in our setting because agents have no information advantage or expertise.

Our theory predicts that rules can dominate discretion and delegation to a pro-business agent can dominate unbiased delegation whenever there exists an irreducible minimum level of regulation. Constraints on the minimum level of regulation arise naturally in different settings. First, these constraints can result from the nature of the regulatory instrument (e.g., inability to affect firm behaviors when no regulation is imposed.) For example, laws governing reporting or disclosure can do no less than require no disclosure or reporting. Nor can safety and environmental regulation mandate that products become more dangerous or that firms pollute more. Constraints may also arise due to the structure of the government. State regulators are constrained by Federal regulation in the United States. Nation states are also constrained by treaties or supra-national entities like the European Union (EU). These higher levels of government impose minimum levels of regulation (e.g., the Clean Air and Clean Water Acts in the United States and Health and Safety at Work Framework Directive in the EU) which increase the risk that no (additional) regulation is over-regulation.

The results of this paper show that the internal structure of the bureaucracy (the regulatory framework, the preferences of agents in charge of it) depends on the behavior of regulated actors such as firms. Furthermore, depending on the nature of regulatory uncertainty, different forms of internal structure might be optimal. Taking into account regulated firms' anticipated behavior does not lead to monolithic prediction: the internal structure of bureaucracy and the regulated firms' behavior are not easily addressed independently.

1.1 Literature

Our finding that delegation to biased agents can be optimal contrasts with the ally principle at the core of much of the literature on the internal structure of the bureaucracy. This literature focuses on the uncertainty faced by a principal and the optimal level of discretion to grant to a better informed and possibly biased agent. Whenever possible, the principal chooses "an ideological clone of one's self as one's agent" (Gailmard and Patty (2012b), page 5). She also grants more discretion to an agent with similar preferences (Epstein and O'Halloran (1994)], when uncertainty is high [Gailmard and Patty (2012a), Bendor et al. (2001), Moe (2012)), or when she wants to encourage the acquisition of expertise [Gailmard and Patty (2007)].

Several papers however highlight a variety of conditions under which the ally principle fails to hold. Bendor and Meirowitz (2004) and Gailmard and Patty (2012b) show that the ally principle fails when the principal needs to incentivize an agent to collect costly information (see also Dewatripont and Tirole (1999)). In our setting, information about the state of the world is costlessly acquired once a firm has invested, thus the failure of the ally principle in our model originates from a wholly different channel unexplored in these models: the impact of regulatory uncertainty, as determined by the regulatory framework, on firms' behavior, and vice versa.

Other papers document failure of the ally principle when firms are better informed than bureaucrats. Boehmke et al. (2006) show that a principal might prefer to appoint ideological distinct bureaucrats to screen better informed special interest groups and improve the effi-

ciency of information transmission. Laffont and Tirole (1993) consider how regulators can incentivize monopolies to reveal their private information through mechanisms that condition regulation on industry reports, and thus limit discretion. In a similar vein, Gailmard and Patty (2012b) analyze the value of appointing agents favorable to business as a means of extracting valuable information from a regulated industry. McCarty (2013) considers a similar mechanism via self-regulation. Gordon and Hafer (2007) analyze how when they are uncertain on the impact of regulation, politicians choose a regulatory framework to maximize firm's contributions. Carpenter and Ting (2007) show that the regulatory stance and the behavior of firms are self-reinforcing: more skeptical regulators lead to more provision of information by regulated firms.[2] In our paper, no actor has private information, nonetheless the ally principle fails to hold because of the strategic responses of regulated actors to the regulatory framework.

Our findings on the benefit of delegation to biased agents echo results in the central bank literature that politicians can be better off appointing conservative central bankers who care about inflation more than they do.[3] Furthermore, as in our paper, this literature shows that rule can lead to more socially beneficial outcome than delegation to a welfare-maximizing central banker (Athey et al. (2005)). Our paper highlights that in a bureaucratic setting, the nature of regulatory uncertainty plays a central role.

2   Model Set-up

In this section, we present a model which illustrates how the organization of the bureaucracy depends on the strategic interactions between the principal, her bureaucratic agent, and regulated firms.

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[2]In a slightly different note, Gailmard and Patty (2013) show that a principal can use delegation in one policy domain to incentivize truthful sharing of information in another policy domain. Since allies are more willing to share information with the principal, the principal grants more discretion to an agent with distinct preferences than hers. Notice that this partial failure of the ally principle arises again as a consequence of asymmetries of information.

[3]It can also be related to the finding that patents are essential to generate investment in Research & Development.

A firm decides whether to enter a new market. Entry requires an irreversible, fixed cost of investment, $C \geq 0$. The cost of investment is initially unknown to all and becomes observable only after the regulatory environment is in place. It is common knowledge that C is distributed over the interval $[\underline{C}, \overline{C}]$, with $0 \leq \underline{C} \leq \overline{C}$, according to some cumulative distribution function, $F(.)$.[4] If the firm does not enter, its profit is 0 so the firm enters the market if and only if the expected profit conditional on entry exceeds the cost of investment C. If the firm enters, it becomes a monopoly provider facing linear consumer demand:[5]

$$D = (1 - \kappa p) \tag{1}$$

Where p denotes the price charged by the firm and the parameter κ determines the slope of the demand curve. The firm profit also depends on the level of regulation $R \in [0, 1]$ which affects the costs of production of Q units of the good: $c(Q; R) = \frac{Q^2}{(1-R)}$.[6] The firm's profit function is:

$$\Pi(Q; R) = pQ - \frac{Q^2}{(1 - R)} \tag{2}$$

Production in the new market generates a per unit degree of externality, S, which takes one of two values $\{\underline{S}, \overline{S}\}$. The realized degree of externality is unknown before the firm investment, but is revealed to all players after investment is realized. It is common knowledge that the level of externality is low ($S = \underline{S}$) with probability q. Regulation imperfectly addresses the externality. In addition to increasing the marginal cost of production, regulation mitigates the externality proportionally: When the level of regulation is R, the cost of externality is equal to $(1 - R)SQ$.

The principal cares about consumer surplus ($CS(Q; R)$), the firm's profit and the total level of the externality. We parameterize the principal's utility as a weighted sum:

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[4]The main thrust of our argument still holds if costs are deterministic i.e. $\underline{C} = \overline{C}$

[5]We consider the case of multiple entrants in section 6.

[6]In an extension, we consider the case when a tax can be used as a regulatory instrument and show that our main results hold in this setting.

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$$W_P(R; S, \alpha_P) = \alpha_P CS(Q; R) + (1 - \alpha_P - \gamma)\Pi(Q; R) - \gamma(1 - R)SQ \qquad (3)$$

The parameter α_P corresponds to the principal's bias in favor of consumers relative to business. We fix $\gamma \in (0, \frac{1}{2})$ to focus the analysis on the degree of bias towards consumers or business interests. Notice that that the principal is always weakly better off when the firm invests.[7]

The principal chooses a regulatory framework which consists first of a decision to establish a rule or to grant discretion to an agent (delegation). A rule is a fixed level of regulation imposed prior to the firm's investment and the realization of the degree of externality. Under discretion, the agent chooses the level of regulation after the firm's investment and can condition it on the realized degree of the externality.

In addition, under discretion, the principal decides to whom she delegates. That is, the principal chooses an agent with a different bias in favor of consumers (i.e., α_A needs not be equal to α_P). The utility function of the agent with bias α_A is:

$$W_A(R; S, \alpha_A) = \alpha_A CS(Q; R) + (1 - \alpha_A - \gamma)\Pi(Q; R) - \gamma(1 - R)SQ \qquad (4)$$

We say that an agent is *unbiased* if the agent shares the same preference as the principal: $\alpha_A = \alpha_P$. We call an agent *pro-consumer* if the agent weights consumer surplus more than the principal: $\alpha_A > \alpha_P$. In turn, we call an agent *pro-business* if the agent weights the firm's profit more than the principal: $\alpha_A < \alpha_P$. To summarize, the timing is as follows:

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[7]In section 6, we consider the case where the principal may prefer to forestall investment.

1. Principal chooses between rule or granting discretion to an agent

If the principal chooses rule:	If the principal grants discretion:
2. Principal chooses the level of regulation $R^r \in [0,1]$, observed by all	2. Principal chooses an agent with bias α_A, observed by all
3. The investment cost, C is realized and the firm decides whether to enter the new market.	3. The investment cost, C, is realized and the firm decides whether to enter the new market.
4. If the firm enters the market, the externality is realized	4. If the firm enters the market, the degree externality $S \in \{\underline{S}, \overline{S}\}$ is realized and the agent sets the level of regulation: $R^d(S)$.
5. Payoffs are realized.	5. Payoffs are realized

For simplicity and clarity of exposition, we make the following assumption related to the firm's investment cost and the principal's preferred rule. Let the unconstrained rule be the level of regulation that the principal would impose ex-ante assuming (possibly naively) that the firm always invests. We assume that under this unconstrained rule, the firm does in fact always invest (i.e. $\overline{C}$ is sufficient low). The principal can thus choose her preferred rule, which we denote the welfare-maximizing rule, without worrying about the firm investing or not. In our extension section (Section 6), we discuss the robustness of our results to relaxing this assumption.

3 Rules versus Unbiased Discretion

In this section, we consider the problem of a principal deciding between a rule-based regulatory framework and delegation to an unbiased agent. It seems natural to assume that the ally principle holds in this setting since there is no private information and no need to incentivize information acquisition. Nonetheless, we show that there are situations where the the ally principle fails: the principal prefers to establish a rule rather than to delegate to an unbiased agent because a rule acts as a commitment device that resolves the regulatory uncertainty faced by the firm and encourages investment.

We first show that for a given degree of externality, the level of regulation is unique. As the level of regulation increases, an increasing share of the externality is mitigated. On the other hand, increased regulation increases the cost of production which reduces the quantity produced, firm profit, and consumer surplus as illustrated in Figure 1.
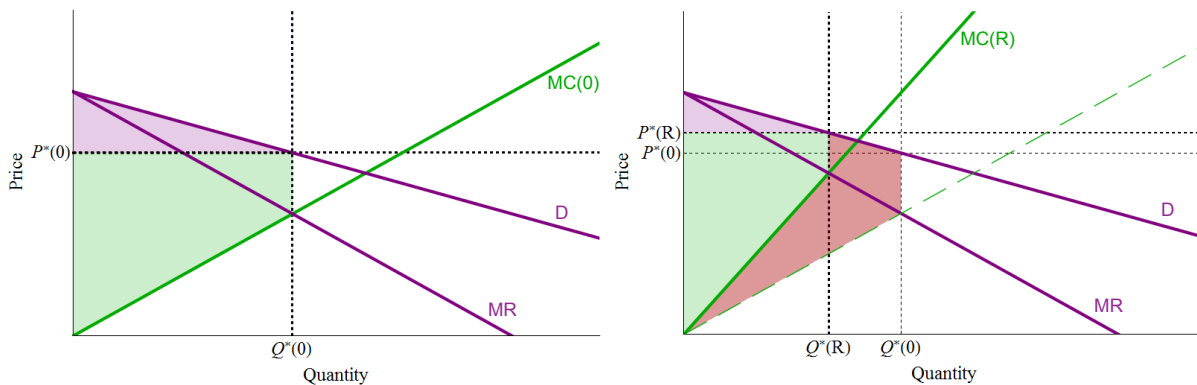
(a) Market equilibrium with no regulation   (b) Market equilibrium with regulation

Figure 1: Market equilibrium with different levels of regulation

The green area below $P^*(.)$ corresponds to the firm's profit, the purple area above $P^*(.)$ to the Consumer Surplus, the dark red area to the loss associated with a positive level of regulation ($R = 0.5$). Parameter value: $\kappa = 1$.

The intent of regulation is to reduce the costs imposed by the externality. These costs depend on both the quantity produced and the degree of the externality. Regulation affects both of these components. Increased regulation has a direct effect by mitigating the cost associated with a given degree of the externality. Regulation also has an indirect effect by

increasing the firm's marginal cost of production and reducing production. When the level of regulation is low, a small proportion of the cost of externality is mitigated and production is high. Consequently, there is a high benefit from increasing the level of regulation. In turn, when the level of regulation is high, a high proportion of the cost of externality is already mitigated and production is low. Consequently, there is a low benefit from increasing the level of regulation. As such, fixing the degree of externality, as the level of regulation increases, the marginal benefit of regulation decreases.[8]

Inversely, more regulation increases the firm's (marginal) cost at an increasing rate. As such, as the level of regulation increases, the marginal cost of regulation increases. The combination of decreasing marginal benefits and increasing marginal costs implies that for any degree of externality, there exists a unique optimal level of regulation. (See Lemma 1 in Appendix A for a formal statement and proof).

There exists a positive correlation between the degree of externality and the level of regulation. As the costs of regulation are unaffected by the degree of externality, the total level of regulation is weakly increasing in the degree of the externality. However, for a low level of externality the marginal benefit of regulation is extremely low, whereas the marginal costs imposed by regulation are always bounded away from zero: regulation affects both the firm's profit and the consumer surplus through the higher price charged by the firm. Consequently, no regulation is optimal for a low degree of externality: There exists a threshold $\widehat{S}$ such that whenever the degree of externality S is lower than this threshold, no regulation is optimal (see Lemma 1). Otherwise, a strictly positive level of regulation, strictly increasing in the degree of externality, is optimal.

The optimal level of regulation displays another interesting property with respect to the degree of externality. Since regulation conveys decreasing marginal benefit and increasing marginal cost, the optimal regulatory response associated with an increase in the degree of externality is decreasing with the degree of externality. That is, whenever the level of

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[8]As we show in Section 6 when we consider taxation as a regulatory instrument, the reduction in production rather than the mitigation of externality is the main force driving this result.

regulation is positive (equivalently, $S > \widehat{S}$), the optimal level of regulation is concave in the degree of externality as illustrated in Figure 2 (see also Lemma 2 in Appendix A).
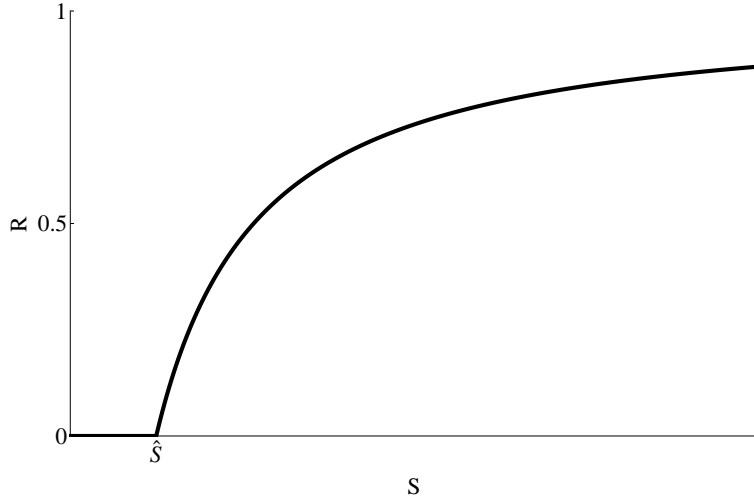

Figure 2: Level of regulation as a function of the degree of externality

Parameter values: $\kappa = 1,\ \alpha_P = 0.3,\ \gamma = 0.4$

Since regulation increases the firm production cost, the level of regulation is inversely correlated with the firm profit. Consequently, for low degrees of externality $(S \leq \widehat{S})$, the firm profit is constant since there is no regulation. For high degrees of externality, the firm profit is decreasing in the degree of externality. Since the level of regulation increases at a decreasing rate with the degree of externality, the cost imposed on the firm increases at a decreasing rate with S. That is, whenever the level of regulation is strictly positive (equivalently, $S > \widehat{S}$), the firm profit is convex in the degree of externality as illustrated Figure 3 (see also Lemma 4 in Appendix A). This convexity arises as a consequence of the regulatory response, and not from a risk-seeking behavior by the firm.
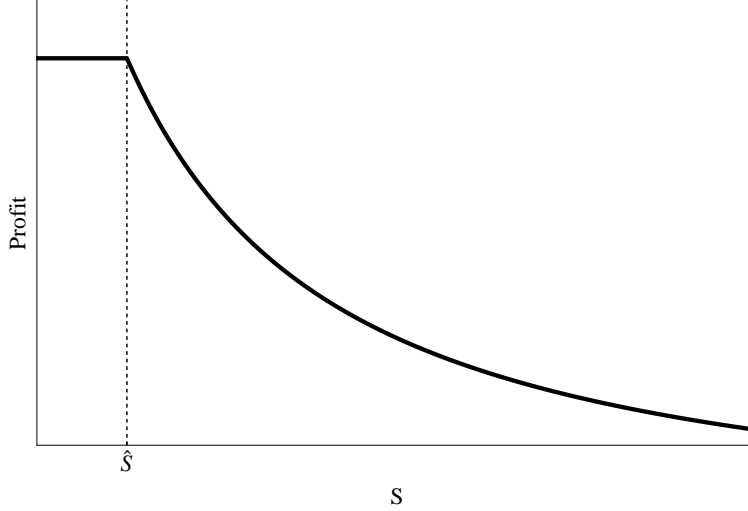
Figure 3: Firm profit as a function of the degree of externality

Parameter values: $\kappa = 1$, $\alpha_P = 0.3$, $\gamma = 0.4$

The previous analysis characterized the optimal level of regulation for different degrees of externality. However, the actual regulation faced by the firm depends on the regulatory framework. Under rule, the level of regulation is based on the expectation of the degree of externality. Under discretion, *if* the firm invests, the level of regulation depends on the realized degree of externality ($\underline{S}$ or $\overline{S}$). Thus, a rule is associated with regulatory certainty for the firm, delegation is associated with ex-post efficiency for the principal.

However, the firm does not always value more regulatory certainty. As Figure 4 illustrates, when the regulatory uncertainty is about how much the firm will be regulated (that is, the level of regulation is always strictly positive: $\underline{S} \geq \widehat{S}$), the firm profit is higher under discretion than under the welfare-maximizing rule. Under discretion, the firm faces a lottery over two outcomes: The levels of regulation and associated profits when the degree of externality is low ($\underline{S}$) and high ($\overline{S}$). Since the firm profit is convex in this range, the firm strictly prefers this lottery over the certain level of regulation based on the expected level of externality imposed by the rule.[9]

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[9]Observe that the logic described above applies to any finite number of states as well as a continuous state variable.
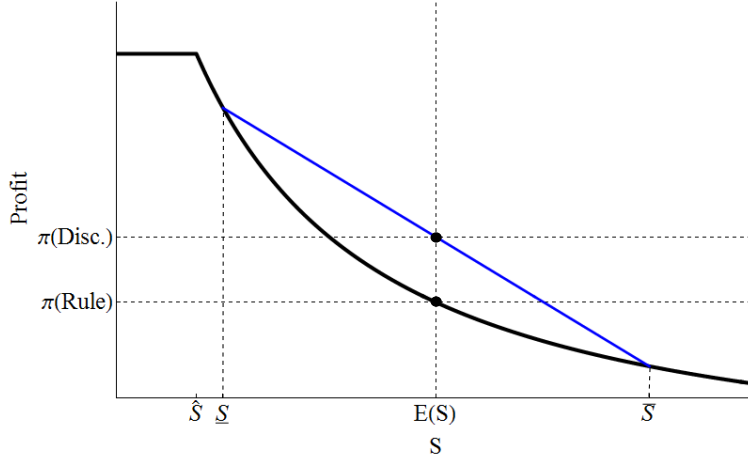
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Figure 4: Profit under different regulatory frameworks for high degrees of externality

Parameter values: $\kappa = 1$, $\alpha_P = 0.3$, $\gamma = 0.4$, $\underline{S} = 0.25$, $\overline{S} = 1.25$, $q = 0.5$

In turn, when the optimal level of regulation in the low state $(S = \underline{S})$ entails no regulation, the firm's profit can be strictly higher under rule. When the degree of externality is low, the benefit of regulation is too low to justify the cost of imposing a strictly positive level of regulation. Furthermore, the unconstrained optimal level of regulation is negative. Since this is infeasible whether because negative regulation is impossible or there is a minimum level of regulation imposed by higher level of government in a federal or supranational system, there is "over-regulation" when the degree of externality is low.

Under discretion, the agent cannot commit to under-regulate in state $S = \overline{S}$ to compensate for over-regulation in state $S = \underline{S}$. She chooses a high level of regulation when $S = \overline{S}$. In contrast, under the rule, the principal balances over-regulation in the low state $(S = \underline{S})$ and under-regulation in the high state $(S = \overline{S})$. The heightened cost of over-regulation in the low state leads the principal to impose a very lenient rule. Consequently, the expected level of regulation can be strictly lower and the firm's expected profit strictly higher under the rule than under discretion. Such a case is illustrated in Figure 5.[10]

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[10]Notice that even if $\underline{S} < \widehat{S}$, discretion leads to greater expected profit if the degree of externality in the high state $(S = \overline{S})$ is sufficiently large and the high state is sufficiently likely to occur (q is sufficiently large). See Lemma 6 in Appendix A for details. The analysis of this case parallels the analysis of the case when there is strictly positive regulation in both states and is excluded from the text for brevity.
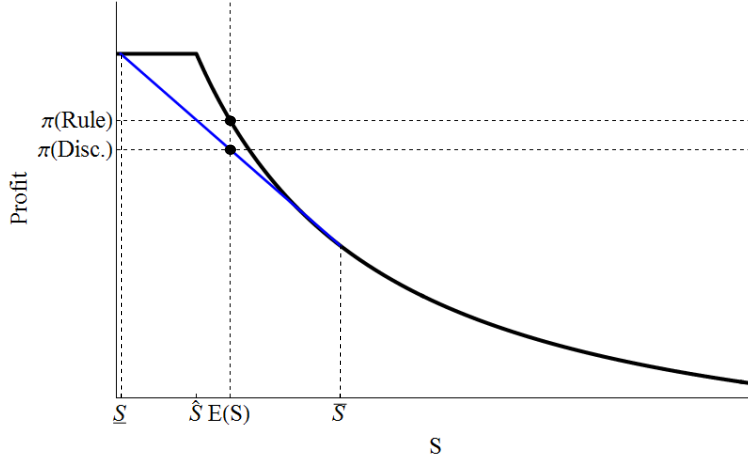
Figure 5: Profit under different regulatory frameworks for low degrees of externality

Parameter values: $\kappa = 1$, $\alpha_P = 0.3$, $\gamma = 0.4$, $\underline{S} = 0.01$, $\overline{S} = 0.525$, $q = 0.5$

Having examined the relationship between the regulatory framework and the firm's profit, we now return to the principal's decision to enact a rule or to delegate to an unbiased agent.

With delegation to an unbiased agent (discretion), the principal can achieve full ex-post efficiency. When regulatory uncertainty is about how much the firm will be regulated, discretion also leads to higher expected profit than the rule and the firm invests with probability 1 under both regulatory frameworks. Thus, the principal strictly prefers discretion—that is, delegation to an unbiased agent—since it is ex-post efficient and encourages investment. The ally principle holds in full when regulatory uncertainty is how much the firm will be regulated.

The conclusion is very different when regulatory uncertainty is about whether the firm will be regulated. In this environment, discretion leads to lower expected profit than a rule. The principal then trades-off ex-post efficiency with a lower ex-ante probability of investment. When it is very likely that the cost of investment is high, such that there is a lower probability that the firm invests under discretion, the principal prefers the welfare-maximizing rule even at the expense of ex-post efficient regulation because the rule gives the principal ex-ante commitment power.[11] (Proposition 1 in Appendix A formally establishes this result).

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[11] By higher probability, we mean that there is sufficient probability mass on high investment costs. First order stochastic dominance would satisfy such condition, but is stronger than required. See Proposition 1 for more details.

Consequently, the ally principle fails to hold in these circumstances. The principal wants to reduce the discretion granted to an agent with similar preferences as her own.

4 Optimal Biased Delegation

In the previous section, we have assumed that the principal can only delegate to an unbiased agent, that is an agent who shares her preferences. Now, we enrich the set of possible delegates and show that given freedom to choose agents of any bias, a principal always does better under discretion than under a rule. When regulatory uncertainty is whether the firm will be regulated, the principal then finds it optimal to delegate to a pro-business agent: the ally principle is reversed.

When the regulatory uncertainty is about how much the firm will be regulated, we know that the ally principle holds and the principal will always prefer delegation to an unbiased agent. This type of delegation has no effect on the probability of investment by the firm and leads to ex-post efficient regulation for the principal.[12]

When regulatory uncertainty is about whether the firm will be regulated, the rule does better than delegation to unbiased agent, but delegation to an appropriately chosen pro-business agent is better than the rule for the principal. The pro-business agent weights the profit of the firm in his utility function more than the principal. Therefore, for any degree of externality the pro-business agent chooses a lower level of regulation than an unbiased agent. As Figure 6 illustrates, this leads to greater profit for the firm.[13]

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[12]This result also holds for the case described in footnote 10.

[13]See Lemma 5 in Appendix A for a formal proof. Notice however that for very large $\underline{S}$, the level of regulation in $\underline{S}$ is almost the same for an unbiased and a pro-business agent. In this case, biased delegation does not necessarily improve upon the rule for the principal (see Proposition 2 for more details).
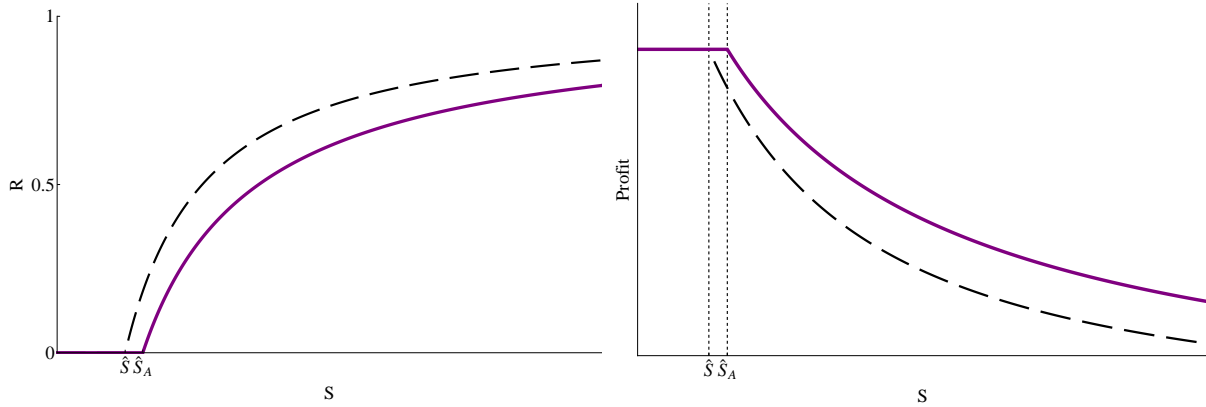
(a) Level of regulation with pro-business agent   (b) Profit with pro-business agent

Figure 6: Market equilibrium with different levels of regulation

Dashed black line corresponds to the level of regulation and profit with an unbiased agent, the solid purple line under a pro-business agent. Parameter values: $\kappa = 1$, $\alpha_P = 0.3$, $\alpha_A \approx 0.067$, $\gamma = 0.4$, $\underline{S} = 0.01$, $\overline{S} = 0.525$, $q = 0.5$

Suppose the principal chooses a pro-business agent such that the expected profit of the firm under the pro-business agent is equal to the profit under the rule. This guarantees the firm invests with probability 1. Furthermore, whenever the rule leads to strictly positive level of regulation, the principal is strictly better off with biased delegation. In the low state $(S = \underline{S})$, she achieves her first best level of regulation and in the high state $(S = \overline{S})$, the level of regulation is lower than her first best, but strictly higher than the rule. Figure 7 illustrates this result, which is formally proven in Proposition 2 in Appendix A.[14]

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[14]As we show in Proposition 2, the principal is always (i.e., for any cost of investment distribution) strictly better off with biased delegation as long as $\overline{S}$ is not too high and the level of regulation under rule is strictly positive. Furthermore, notice that choosing a pro-business agent who replicates the firm's expected profit under the welfare-maximizing rule always does better than the rule, but might not be the optimal strategy for the principal.
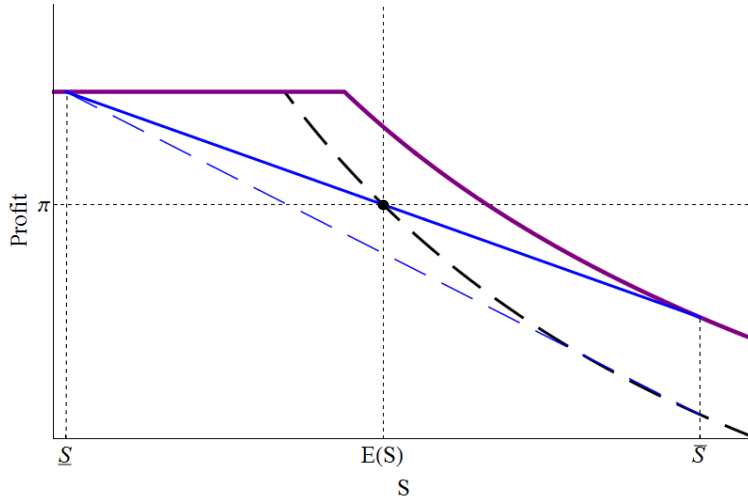
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Figure 7: Discretion to a pro-business agent

Dashed lines correspond to the decision and profit with an unbiased agent, purple solid line to the decisions and profit with a biased agent. Parameter values: $\kappa = 1$, $\alpha_P = 0.3$, $\alpha_A \approx 0.067$, $\gamma = 0.4$ $\underline{S} = 0.01$, $\overline{S} = 0.525$, $q = 0.5$

In these circumstances, the ally principle is reversed. The principal prefers to delegate to a pro-business rather than an unbiased agent. By doing so, she gains some of the ex-ante commitment power of the rule (increases the probability that the firm invests compared to unbiased delegation) and recovers some of the ex-post efficiency of delegation to an unbiased agent (given investment). Observe that the principal prefers a biased agent even though her agent has neither special expertise nor an informational advantage over her.

5 Limits on Delegation to Biased Agent

In the previous section, we assume that every type of agents is available and the principal can commit to retain the agent in all states. Focusing on the case when rule dominates unbiased delegation (i.e., the regulatory uncertainty is whether the firm will be regulated), we discuss how our results are affected when both assumptions are relaxed.

First, for delegation to dominate rule, it is necessary that the set of available agents, denoted hereafter $\mathcal{A}$, contains sufficiently diverse agents. If the available agents are all highly pro-business, the principal might be better off with a rule. Delegation to a highly pro-business

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agent encourages investment.[15] But it also implies that the level of regulation is always too low in the high state ($S = \overline{S}$). It can be so low that the loss induced by under-regulation in the high state overweights the possible gain from encouraging investment and achieving a level of regulation close to the principal's ideal in the low state. This result corresponds to the well-known cost associated with drift in delegation models (as such, it extends naturally to the case when uncertainty is about how much the firm will be regulated).

Delegation might also be suboptimal compared to rules if the available agents are too similar to the principal. If agents have almost the same preferences as the principal, the level of regulation will be very similar and (for a set of distributions of investment cost) delegation does not buy enough ex-ante commitment power to induce a sufficiently large increase in the probability of investment. The principal then maintains an ex-post inefficient rule.

These results are illustrated in Figure 8 where agents with little bias in favor of business only induce a small increase in the probability of investment. This leads to only a small increase in the principal's expected welfare who then still prefers the welfare-maximizing rule to biased delegation. In contrast, agents too biased in favor of business guarantee investment, but under-regulate too much in the high state from the principal's perspective so she prefers the ex-post inefficient welfare-maximizing rule. More policy divergence between the principal and an agent can thus lead to more discretion, but the relationship is non-monotone.[16]

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[15]In the previous section, we have shown that the principal is always better off when she delegates to a pro-business agent who replicates the profit induced by the welfare-maximizing rule and thus leads to investment with provability 1. Therefore, agents that are so pro-business that the principal prefers a rule must also lead to firm investment with probability 1.

[16]In Appendix A, we provide simple conditions such that the principal does not delegate to agents too biased in favor of business or too similar to herself (see Corollaries 2 and 3).
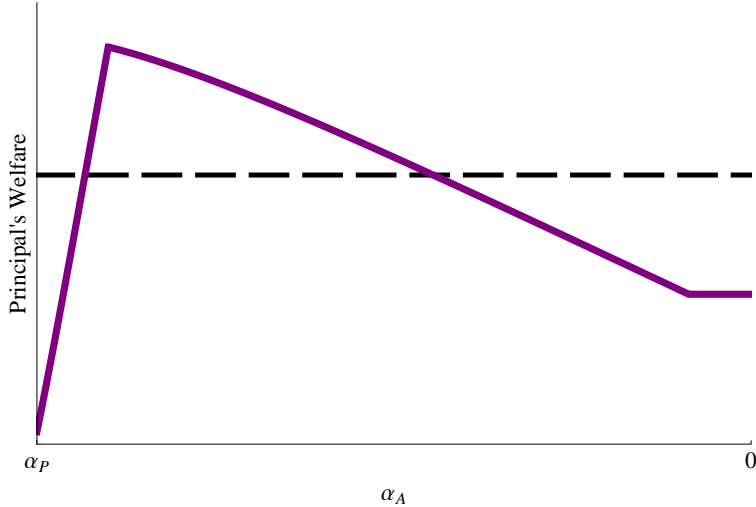
Figure 8: Principal's welfare as a function of agent's bias

Dashed black line is the principal's welfare under the welfare-maximizing rule. Solid purple line is for discretion with agent with bias α. Parameter values: $\kappa = 1$, $\alpha_P = 0.55$, $\gamma = 0.4$, $\underline{S} = 0.01$, $\overline{S} = 0.24$, $q = 0.2$, $F(C) = (C - \underline{C})^2 / (\overline{C} - \underline{C})^2$, $\underline{C} = 0.08$, $\overline{C} = \pi(Rule) \approx 0.098$

While a lack of appropriate agents may limit the appeal of delegation, another problem lies in the principal's inability to commit not to replace the agent. This problem arises when the cost for the principal of replacing agents is low, while the cost of changing regulatory frameworks is relatively high. For example, in the US, since the establishment of the Chevron Doctrine, the operations of agencies are constrained by the intent of the law. As such, moving from a rule-based regulatory framework to a discretion-based framework requires legislative intervention. Conversely, the President's authority to replace agency heads is well documented and used (e.g., Lewis (2008), but see Gailmard and Patty (2012b), pages 236-7, for a discussion of the limits to such authority.)

After delegating to an optimally pro-business agent, the principal never wants to replace him once it is revealed that the degree of externality is low ($S = \underline{S}$) since both prefer no regulation. However, in the high state, the biased agent under-regulates from the principal's perspective. Since investment has already been undertaken when the externality is revealed to all players, the principal has an incentive to replace the sitting bureaucrat with an agent with preferences closer to her own. The commitment problem is especially acute when it is very likely that the costs of investment are high, since the principal must delegate to a

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pro-business agent with preferences far away from her own to induce investment with high probability. When the investment cost is likely to be high, the principal is then unable to commit to retaining a pro-business agent whenever the cost of replacing the agent is low as illustrated in Figure 9. Anticipating this, the firm does not find the principal's commitment to a pro-business agent credible and invests as if it was facing an unbiased agent. In such a scenario, the welfare-maximizing rule dominates any form of delegation.
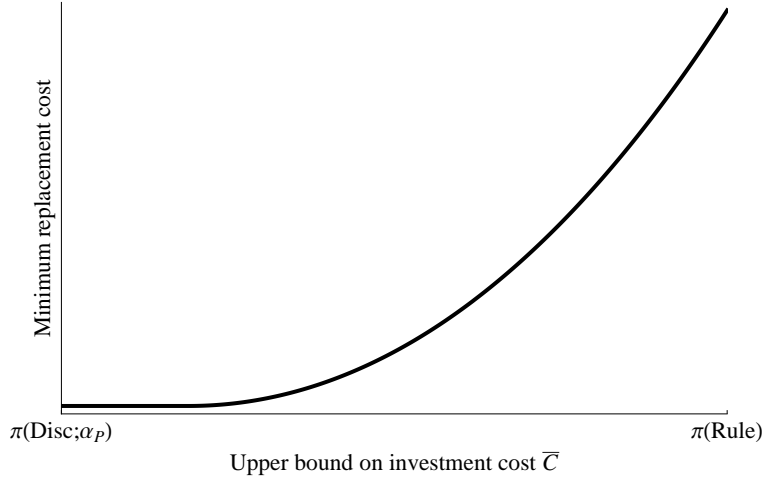

Figure 9: Minimum replacement cost required to commit to sufficiently pro-business agent as a function of $\overline{C}$

Parameter values: $\kappa = 1$, $\alpha_P = 0.55$, $\gamma = 0.4$, $\underline{S} = 0.01$, $\overline{S} = 0.24$, $q = 0.2$, $F(C) = (C - \underline{C})/(\overline{C} - \underline{C})$, $\underline{C} = 0.085$

In our setting, the principal delegates to a pro-business to encourage firm investment. A biased agent has no informational or expertise advantage. Consequently, once investment is realized, the principal cannot commit not to replace her agent when the degree of externality is large and replacement costs are low. A then rule resolves both the ex-ante firm regulatory uncertainty and the ex-post principal's commitment problem. Despite the associated ex-post inefficiency, a rule can dominate any form of discretion.[17] This novel endogenous limit to delegation arises due to firms' strategic behavior. In fact, it is firms' strategic response to

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[17]Notice that since a rule solves both commitment problems, the principal might be better off if the cost of changing the regulatory frameworks is sufficiently high (we prove this claim more formally in Appendix A).

the regulatory framework which incentivizes a principal to delegate to an agent who differs from her *only* in term of policy preferences in the first place.[18]

6   Extensions

In this section we present a series of extensions to demonstrate the robustness of our results. We first show that a rule can dominate unbiased delegation when multiple firms can enter the market. We then return to the case of a single potential entrant and relax the assumption that the principal can always impose the unconstrained rule that maximizes her expected utility. Third, we show that the ally principle also does not always hold when the principal seeks to avoid a firm exiting a market or when the firm investment is welfare reducing. Finally, we show that even when regulation takes the form of taxation, a rule can dominate delegation to an unbiased agent.

6.1   Multiple firms

We consider the situation when at most $N > 1$ firms can enter the market. All firms face a common fixed cost of entry and when L firms enter the market ($L \leq N$), they engage in Cournot (quantity) competition.[19] As before, we assume that the welfare-maximizing rule chosen by the principal guarantees that all firms enter the market.

As above, when choosing a level of regulation, an agent trades-off the mitigating effect of regulation on the externality with the costs in term of firms' profit and consumer surplus. Since the trade-offs are similar as in the case of a monopolist, we find that there exists a unique optimal level of regulation for each degree of externality (S) and that the level of regulation is increasing and concave in S (Figure 10 and Lemmas 7 and 8).

The presence of multiple firms, however, has three important consequences. First, it increases the total quantity produced. Second, it increases the consumer surplus (higher

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[18]Naturally, such a commitment problem never arises when the regulatory uncertainty is about how much the firm will be regulated. The principal can then delegate to an unbiased agent who always implements her preferred policy.

[19]For more details on the entry process as well as all formal results and proofs, see Appendix B.

quantity, lower price). Third, it decreases a firm's and the industry (total) profit. These three effects have important implications on the choice of a level of regulation. In fact, an increase in quantity produced worsens the negative impact of any degree of externality. But an increase in the level of regulation at first has little effect on the already low industry profit. An agent who puts a lot of weight on profit relative to consumer surplus in his welfare function chooses a level of regulation taking into consideration mostly the negative externality associated with increased production. Inversely, by decreasing quantity and increasing price, an increase in the level of regulation tends to have a strong negative effect on consumer surplus. An agent who puts a lot of weight on consumer surplus in his welfare function balances the mitigating effect of regulation with the cost for consumers. Consequently, a pro-business agent can be more willing to impose a high level of regulation than a pro-consumer agent since he faces a lower cost of doing so. As such, for low degree of externality, a pro-consumer agent can regulate less than a pro-business agent as shown in Figure 10.[20]

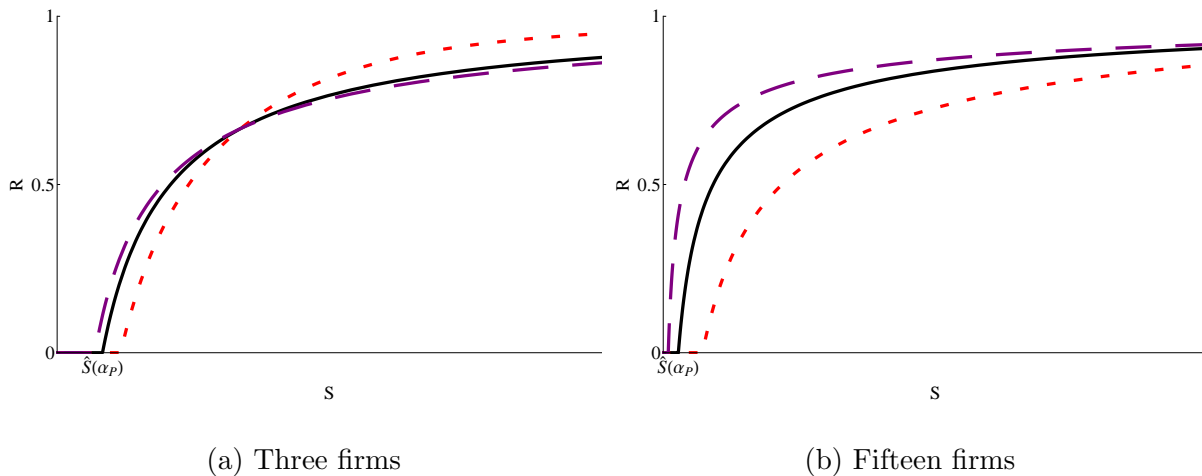(a) Three firms   (b) Fifteen firms

Figure 10: Optimal level of regulation with multiple firms

The plain black line corresponds to the optimal level of regulation for the principal, the purple dashed for a pro-business agent, and the dotted red line for a pro-consumer agent. Parameter value: $\kappa = 1$, $\gamma = 0.4$, $\alpha_P = 0.3$, pro-business agent: $\alpha_A = 0.2$, pro-consumer agent: $\alpha_A = 0.54$.

Also illustrated in Figure 10 is the fact that for a very low degree of externality, the optimal level of regulation is still 0. In fact, as in the case of a monopoly, the agent in charge of

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[20]Since regulation imposes a convex cost on firms, a pro-business agent always regulates less than a pro-consumer agent for high enough degree of externality, see Figure 10a and Lemma 9.

regulation would like to impose a negative level of regulation, but is otherwise constrained by the regulatory instrument or by other jurisdictions (federal state, supranational agreement).[21] Therefore, as long as the firm's profit is decreasing with the level of regulation, the censoring in the optimal level of regulation implies that, as for a monopoly, a rule can lead to higher profit than delegation to an unbiased agent for low degrees of externality. This is the case in Figure 11a (see also Lemma 11). As above, a rule can dominate unbiased delegation since it guarantees entry of a greater number of firms (Proposition 4). Biased delegation dominates both since it gives the principal much of the ex-ante commitment power of a rule while limiting ex-post inefficiencies (Proposition 5). However, given that a pro-consumer agent tends to regulate less than a pro-business agent for low degree of externality, the principal might strictly prefer to delegate to a pro-consumer agent rather than a pro-business to increase the likelihood of entry (Corollary 5).

Competition between entrants, however, also change how regulation affects firms' profit. By increasing the marginal cost, an increase in the level of regulation increases the equilibrium price and *total* cost. While a single firm benefits fully from the increase in price, it only bears a small portion of the cost increase: regulation deadens competitive pressures on profit. Consequently, when the number of firms is large, profit *increases* with the level of regulation for low level of regulation and hence low degree of externality. However, as the cost of regulation is convex for firms, for high level of regulation, profit always decreases in the level of regulation (high degree of externality). A firm's profit thus exhibits an inverse U-shaped relationship with respect to the degree of externality. But this implies that for intermediary degrees of externality, the firm's profit is always strictly lower under unbiased delegation than under rule (Figure 11b). To gain ex-ante commitment power and incentivize firms entry, the principal thus prefers a rule-based regulatory framework over unbiased delegation despite the ex-post inefficiencies associated with it (Proposition 4).[22]

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[21]By the reasoning above, this occurs whenever the agent puts sufficiently high weight on the consumer surplus (see Corollary 4 for more details).

[22]Notice that unlike the case of a monopoly, a firm's expected profit is higher under rule than unbiased delegation when the level of regulation is strictly positive in both states ($\underline{S}$ and $\overline{S}$). Delegating to a biased agent always induces over- or under-regulation from the principal's perspective. As such, biased delegation does not necessarily limit ex-post inefficiencies and a rule-based regulatory framework can be optimal for
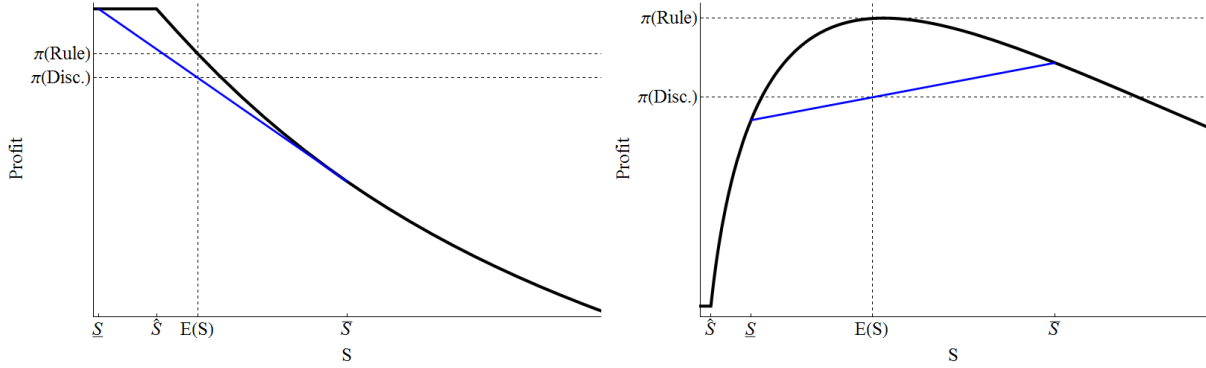
| (a) Three firms | (b) Fifteen firms |

Figure 11: A firm's profit under different regulatory framework

Parameter value: $\kappa = 1$, $\gamma = 0.4$, $\alpha_P = 0.3$ $q = 0.4$, for Figure 11a: $\underline{S} = 0.01$ and $\underline{S} = 0.5$, for Figure 11b:

$$\underline{S} = 0.2, \overline{S} = 1.4.$$

Introducing competition between entrants does not alter our main results. As for a monopoly, the principal prefers a rule-based regulatory framework to a discretion-based regulatory framework to gain ex-ante commitment power and incentivize firms entry. She strictly prefers to delegate to a biased agent (sometimes pro-consumer) to solve her ex-ante commitment power if biased delegation limits ex-post inefficiencies. Since the introduction of competition only complicates the analysis, we return to the case of a single firm in what follows.

6.2 Constrained rules and inherited rules

Returning to the case of a single firm, a rule can still dominate discretion when the welfare-maximizing rule chosen by the principal does not induces investment with probability 1. In this case, the principal trades-off her preferred level of regulation given investment against the necessity of a sufficiently lenient level of regulation to guarantee investment with high probability. The principal then chooses a *constrained rule*: That is, a (weakly) lower level of regulation than the welfare-maximizing rule. The probability of investment under the

the principal. This suggests that rule-based regulatory frameworks might be optimal for very competitive industries, while discretion to a biased agent might be optimal for industries exhibiting relatively low level of competition. A full characterization of this result is left for future research.

constrained rule is strictly higher than under unbiased delegation. Consequently, the logic described above still applies and a rule dominates unbiased delegation under certain conditions.

A similar logic explains why rules can be persistent even if not optimally suited to current circumstances. For example, a principal might inherit a regulatory framework that is not ideally suited to the current environment. If the inherited rule guarantees investment by the firm with sufficiently high probability, then it can dominate unbiased delegation. If the welfare loss relative to welfare-maximizing rule is small, then the principal may maintain the inefficient rule whenever there are costs associated with regulatory change.

6.3 Avoiding exit

Our main results still hold when firms must decide whether to stay or exit a market. That is, the firm must decide whether to continue to employ capital in an existing market or allocate it to new activities which provide a profit $\Pi^O > 0$ (possibly revealed after the regulatory framework is established). In this case, the principal seeks to avoid the firm exiting the market. Her choice of a regulatory framework must take into account the firm's disinvestment decision. If the degree of externality changes over time and the nature of regulatory uncertainty faced by the firm is about whether it will be regulated, the logic outlined above indicates that the principal chooses a rule over unbiased regulation under certain conditions.[23]

Firms might also choose to stay in the same market, but move production plants to another jurisdiction. Our model then predicts that jurisdictional competition can not only lead to deregulation (also known as 'the race to the bottom', Oates (1972)), but also can induce the adoption of an ex-post inefficient regulatory framework.

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[23]A similar result holds when the firm is uncertain whether it will face new regulation in a second dimension.

6.4 Welfare-reducing investment

Rules can also dominate discretion when the principal ex-ante prefers the firm to allocate resources to other sectors. This occurs when the principal gets higher expected utility from investment in other sectors or when there is a fixed cost for the principal associated with investment, such as the environmental cost associated with fracking or the systemic risk induced by investment in risky derivatives.

When the principal wants to discourage investment, the principal may prefer a rule when it reduces the firm's expected profit so much that it does not invest. In contrast to the previous results, the ally principle fails and the principal strictly prefers a rule when the regulatory uncertainty is about *how much* the firm will be regulated (see Figure 4).

The principal can also choose to delegate to a sufficiently *pro-consumer* agent who always regulates more than the principal (conditional on investment) and prevents the firm from entering the market. In contrast to our previous results, the principal is never strictly better off by delegating to a pro-consumer agent than by imposing a rule. In both cases, investment is discouraged and the principal gets the utility from her outside option.

6.5 Other regulatory instrument

Another type of regulatory instrument available to the principal is taxation. Taxation imposes a linear cost on the firm. Nonetheless, we show that our results still hold in this setting. The principal chooses either a per-unit tax $t \in [0, 1]$ before investment (like a "rule"), denoted t^r, or to delegate to an agent the tax decision to be taken after investment (like discretion), denoted $t^d(S)$. The firm's profit is now:

$$\Pi(Q; t) = pQ - Q^2 - tQ \tag{5}$$

The consumer's demand is the same as before (see equation (1)) and the utility of the principal (P) and agent (A) is:

$$W_J(t; S, \alpha_J) = \alpha_J CS(Q; R) + (1 - \alpha_J - \gamma)\Pi(Q; t) - \gamma(S - t)Q, \ J \in \{A, P\} \qquad (6)$$

As before, an increase in the tax rate is associated with a reduction in the cost of the externality ($(S - t)Q$) on the one hand, and in consumer surplus and firm profit on the other hand. As taxation increases, the firm produces less and the social cost of the externality becomes less important. As for direct regulation, the marginal benefit of taxation is decreasing with the degree of externality: the optimal tax is concave in the degree of externality.

However, taxation has an additional effect compared to direct regulation. Taxation generates revenues for the principal which do not depend on the degree of externality. Consequently, when the principal places little weight on consumer surplus and firm profit (γ high) then for all levels of the externality, the principal implements a strictly positive tax.[24] The regulatory uncertainty faced by the firm is always how much it will be regulated and the ally principle prevails.[25]

Censoring however occurs when the principal puts sufficient weight on the consumer surplus and firm profit (γ is sufficiently low).[26] In this case, there exists a strictly positive level of externality, $\widehat{S}^t$ such that the principal implements a strictly positive tax if and only if $S > \widehat{S}^t$.[27] The regulatory uncertainty is about whether it will be regulated. Consequently, as in our previous setting, under certain conditions, the ally principle fails and is reversed: rule dominates unbiased delegation and delegation to a pro-business agent is always optimal for the principal when feasible.[28]

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[24]In the original setting, as the degree of externality goes to zero, so does the marginal benefit of regulation, therefore the level of regulation goes to zero for all γ.

[25]The notion of what constitutes an ally (unbiased agent) is stronger in this environment as the agent must share the principal's preferences over the use of tax revenue in addition to the principal's relative weight on consumer surplus and profit. This might explain why regulation by agencies rarely takes the form of a tax.

[26]Notice however that if γ is too low, the optimal taxation is always 0 since the principal does not put enough weight on the loss due to the externality and gain from taxation (see Lemma 13 in Appendix B for more details).

[27]Notice that a necessary condition for this result to hold is that the principal cannot subsidize the firm.

[28]See Propositions 6 and 7 in Appendix B for more details.

7　Conclusion

Many papers characterize the optimal organization of the bureaucracy focusing on the internal problems inherent to delegation: the strategic relationship between politicians and bureaucrats. A primary finding emerges from this literature: the ally principal. In this paper, in contrast, we study how the strategic behavior of regulated firms shape bureaucratic organization and the identity of bureaucrats. We show that the ally principle holds when the nature of the regulatory uncertainty is how much the firm will be regulated. The principal always wants to delegate to an unbiased agent since it maximizes the probability of firm investment (ex-ante efficiency) and optimally adapts the level of regulation to the degree of uncertainty (ex-post efficiency). But we also find that there are circumstances under which the ally principal fails to hold and is even reversed. When regulatory uncertainty is about whether the firm will be regulated, discretion to an unbiased agent can lead to too little investment. The principal then prefers a rule-based regulatory framework to unbiased delegation. She also chooses whenever possible to delegate to a pro-business agent.

We also identify a variety of limits on delegation that can also lead a principal to write a rule rather than create a law with discretion. If the pool of possible agents is too similar or too dissimilar to the principal, it may be impossible to achieve balanced biased delegation and a rule might be optimal. Another limit on delegation unique to our setting emerges because agents have no informational or expertise advantage. As such, once the firm investment is realized and uncertainty is resolved, the principal also has incentives to replace a biased agent with an unbiased bureaucrat. When the principal's ex-post commitment problem is stringent, the principal can do no better than imposing an ex-post inefficient rule. Our theory then uncovers endogenous limits to delegation, which have not been previously emphasized.

An important consequence of our results is that the internal structure of the bureaucracy does not depend only on the presence of uncertainty, but also on how firms strategically respond to different regulatory frameworks. As such, the internal structure of bureaucracy and the regulated actors' behavior are not easily addressed independently.

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